# PRESSURE PIPING SYSTEMS

## INTRODUCTION

This chapter defines procedures for designing, fabricating and testing pressure piping systems.

## SCOPE

This chapter includes all piping systems that fall under the scope of ASME/ANSI B31 code series. This includes the following:

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| Section 1 | Power Piping B31.1 |
| Section 2 | Fuel Gas Piping B31.2 |
| Section 3 | Process Piping B31.3 |
| Section 4 | Liquid Petroleum Transportation Piping Systems B31.4 |
| Section 5 | Refrigeration Piping B31.5 |
| Section 8 | Gas Transmission and Distribution Piping B31.8 |

## EXCLUSIONS

The following piping systems are excluded from the requirements of this chapter:

i) Piping systems specifically excluded by the ASME/ANSI B31 code series (e.g. B31.3-1999 excludes "piping systems designed for internal gage pressures at or above zero but less than 105 kPa (15 psi), provided the fluid handled is nonflammable, nontoxic, and not damaging to human tissue as defined in 300.2, and its design temperature is from –29C (-20F) through 186C (366F)…")

ii) Any hydraulic system. All hydraulic systems must conform to either IJ- 100 or SAE J517. Dynamic systems, whose operation falls within the scope of SAEJ517 shall conform to SAE J517. (moved from Policy 2., c., ii)

iii) Mechanical refrigeration systems covered under FESHM 5035.

## DEFINITIONS

Engineering Note: A written analysis demonstrating that a given piping system satisfies the requirements of this chapter.

Qualified Person: A qualified person is "a person who, by possession of a recognized degree or certificate of professional standing, or who, by extensive knowledge, training and experience, has successfully demonstrated the ability to solve or resolve problems relating to the subject matter and work."

## SPECIAL RESPONSIBILITIES

The division/section head who controls the area of operations where the piping system resides is responsible for carrying out the requirements of this chapter. The division/section head, or designee, shall arrange for the review of the piping system by a qualified person.

The ES&H Section shall audit the divisions and sections on their compliance to this chapter. They will also maintain an open master file of all pressure piping system reviews.

The Mechanical Safety Subcommittee shall serve the division/section heads and ES&H Section in a consulting capacity on all piping system matters.

## POLICY

1. All pressure piping systems built and used at Fermilab shall be in accordance with this chapter and the ASME/ANSI B31 code series.

2. Implementation of Policy

    a. *Documentation*: A document shall be prepared by a qualified person for some existing or new pressure piping systems at Fermilab, whether purchased or in-house built. Its purpose is to allow a reviewer to check the design and installation and to inform a future user of the pressure piping system's parameters. The document shall include design calculations for the pressure piping systems and manufacturer's compliance to the ANSI/ASME standard for purchased pressure piping systems. The document shall also include precautions and operation procedures necessary for the safe use of the pressure piping system.

    b. *Review of pressure piping systems*: All pressure piping systems that require a review shall be reviewed by an independent, qualified reviewer, other than the qualified person who prepared it, for concurrence to this chapter.

        A review must occur when either:

        i) The pressure piping system contains over 150,000 ft-lbs of stored energy or the operating pressure is above 150 psi for gas, or 1500 psi for liquid.

ii) The pressure piping system contains any category M fluid as defined by the ANSI B31.3 standard. Radioactive water (RAW) systems are considered a category M fluid for the purposes of this chapter.

c. *Piping Systems with Additional FESHM Chapter Requirements*: Some pressure piping systems must comply with more stringent safety analyses. Additional Fermilab ES&H chapters have been written for these specific systems. The documentation and review requirements for these systems are included in the following chapters:

i) Any flammable gas system covered and reviewed under Fermilab ES&H Manual Chapter 6020.3.

ii) Any cryogenic system covered and reviewed under Fermilab ES&H Manual Chapter 5032.

d. *Systems Excluded from Documentation and Review Requirements*: Many pressure piping systems do not have a sufficient risk factor to justify documents/reviews. Piping systems which fall under this category are:

i) Any category D fluid service as defined by the ANSI B31.3 standard.

e. *Modifications to the pressure piping system*: Any subsequent changes in usage or operation which could affect the safety of the system shall be reviewed in the same manner as the pressure piping system.

f. *Similar pressure piping systems*: Pressure piping systems which are similar to previously constructed and approved pressure piping systems need not be reviewed. Adequate documentation can be provided by referencing the approved engineering analysis and noting any differences. A pressure test will still be required.

g. *Director's Exception*: Exception of the provisions of this chapter shall be allowed only with the signature of the Laboratory Director or his designee and documented. The need for such exceptions is to be minimized by adherence to the provisions of this chapter. Exceptions are to be identified and submitted to the Director for review as early in the design process as possible. These exceptions shall only be allowed after the Director has assured himself that sound engineering practice will be followed during design, fabrication and test of the pressure piping system. The ES&H Section shall maintain copies of exceptions for the Director.

**PROCEDURES AND REQUIREMENTS FOR DESIGN, FABRICATION, INSPECTION ANDTEST**

1. Purchased Pressure Piping Systems: All pressure piping systems purchased by Fermilab or its experimenters shall be made (designed and fabricated) in accordance with the "*Policy*" section of this chapter.

2. In-House Built Pressure Piping Systems: All pressure piping systems built at Fermilab or experimenter's shops shall be designed in accordance with the "*Policy*" section of this chapter.

3. Existing Pressure Piping Systems In Service: All such pressure piping systems must be in accordance with the "*Policy*" section of this chapter.

4. Used Pressure Piping Systems: Used pressure piping systems shall be classified as an existing pressure piping system and will have their previous service taken into account during the review process. Questionable pressure piping systems or those with unknown histories shall be retested per the "*Leak Test*" section of this chapter.

5. Leak Test: All pressure piping systems shall be pressure tested.

    i) The initial service test is considered the pressure test for ASME B31.3 Category D piping systems. No safety officer oversight is required for pressure testing piping systems in this category.

    ii) All other pressure piping systems shall be pressure tested as described per Fermilab ES&H Manual Chapter 5034.

6. Welding/Brazing Information (Fermilab or Experimenter's Welding/Brazing Shops Only): Welding executed at Fermilab shall be done in a manner equivalent to a welding/brazing procedure supplied by the Fermilab Weld Shop. Purchased pressure piping systems should be welded according to the ANSI/ASME piping standard.

7. Component Identification: Components should be labeled to correspond to an up- to- date piping and instrument diagram. Labels are to be permanent, securely attached and easy to read. Each component label should list a unique component number for that system. Guidance may be obtained from ANSI A13.1 "Scheme for Identification of Piping Systems".